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AN INVESTIGATION OF THE VALIDITY AND DIMENSIONALITY OF ANXIETY SCALES

by

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ABSTRACT

This dissertation was designed to explore two related areas, namely, the dimensionality and validity of anxiety scales.

The dimensionality of anxiety scales was investigated by a factor analytic study of the intercorrelations between responses to items on a Selected Anxiety Questionnaire which contained items from the Taylor Manifest Anxiety Scale, the Test Anxiety Questionnaire and the Impulse Gratification Questionnaire. Orthogonal and oblique rotations of factor loadings, obtained by principal axis factoring, showed that factors identified as chronic worry, inferiority-sensitivity and physiological reactions to test situations appeared most relevant. These findings support factorial studies of anxiety scales reported in other sources.

The validity of the Selected Anxiety Questionnaire was studied by analysis of physiological responses of "high" and "low" anxious subjects to threat, anxiety, neutral and blank stimulus items. Significant differences in mean G. S. R. and E. K. G. responses for "high" and "low" anxious subjects were found when threat stimuli were presented; G. S. R. differences were significant for anxiety stimuli. However, the type of G. S. R. and E. K. G. measure that was used did not utilize a change relative to base level ratio. This resulted in a consistent tendency for "low" anxious subjects to show greater change than "high" anxious subjects over all types of stimulus presentations. However, it may be said that the Selected Anxiety Questionnaire is valid in the sense that it discriminates according to base level of physiological

response. This suggestion is compatible with the Hullian notion of general drive level; the Taylor Scale was devised to yield an index of general drive level. Furthermore, it was noted that the Impulse Gratification Questionnaire items showed extremely low intercorrelations and appeared not to measure anything consistently in the sample of university students.

An analysis of G. S. R. and E. K. G. responses of the total group to the different types of stimulus items produced results that had been predicted, i.e., threat items evoked the greatest mean response and the magnitude of response became less as anxiety, neutral and blank items were presented.

The oft-studied relationship between sex and anxiety scale scores was tested. The tendency for females to score significantly higher than males was confirmed once again in this study.

The conclusions and implications of this study are mainly concerned with the possibility of two dimensions of physiological responding. It is tentatively suggested that galvanic skin response may be related to general activation level whereas heart rate seems to be most variable when an individual perceives a situational threat. Much more study is needed in this area to confirm or refute these and other findings.

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CHAPTER I

INTRODUCTION

Psychologists have devoted much time and effort in an attempt to clarify the nature of anxiety, to construct instruments which are considered to be measures of anxiety, and to determine the influence of anxiety on human behavior. The expenditure of effort in an attempt to understand, and thereby to predict and control anxiety, can be considered a function of both its prevalence in humans and states of its elusive nature. Anxiety neuroses constitute a large proportion of total cases in psychotherapy; educators are aware of high frequency of "anxieties" in children and adolescents -- as technological innovation requires greater knowledge to cope with the increasing complexity of our culture, more difficult educational requirements increase the probability of inducing anxiety in young people.

It is generally agreed that the autonomic physiological changes which occur in the body represent a state of anxiety or arousal. Furthermore, anxiety scales are considered to give paper-and-pencil indices of anxiety level although it is difficult to obtain adequate objective validation of these scales. The reliability of such scales has been shown to be moderately high.

This study is concerned with the validity of paper-and-pencil anxiety scales and is unique in that it attempts to relate physiological response to scores on written anxiety scales using a technique heretofore untried. Many studies have been done to test the relation between

anxiety-scale scores and physiological response, but none has attempted to show a relation when items from the anxiety scale constitute stimuli while physiological measurements are taken. If such a relation can be shown, it lends support to the belief that anxiety scales are valid.

However, a general review of research of relevant areas is in order before specific experimental techniques are considered. The review attempts to present information, particularly factor analytic information, which is necessary to understand the nature of anxiety and its influence on learning. Finally, a detailed review of Mandler's (1961) study is done to clarify the design of the present research.

CHAPTER II

RELEVANT RESEARCH

The Nature of Anxiety

In psychoanalytic terminology, anxiety may be defined as a diffuse, pervading apprehensiveness without specific or clearly defined reality referents. Apparently contentless anxiety has its origin in unconscious fear evoked by an external situation symbolic of one that actually threatened the satisfaction or security of the individual in his "forgotten" past. Neurotic anxiety may be considered as a response to earlier dangers evoked by situational symbols to which the individual has become reactively and persistently hypersensitive. Freud (1936) says that anxiety is incorporated into the life of the psyche as a precipitate or resultant of primal traumatic experiences and is evoked in similar situations through memory symbols. The distinction is often made between "phobic" anxiety and "free floating" anxiety. Phobic anxiety or fear is that type which is evoked by a specific object; free floating anxiety, on the other hand, is that state of anxiety which is general or omnipresent due to the fact that a person has generalized the anxiety response to innumerable pervasive stimuli. This is a psychological distinction and not a physiological one because the autonomic response is the same in both cases.

Wolpe (1958) says that anxiety is evoked by a negatively conditioned stimulus. He explains that through stimulus generalization, the individual responds to stimuli which have been associated with the

original stimulus (that evoked anxiety) and in this way becomes conditioned to many stimuli in such a manner that the anxiety response is proportionate to the position of the impinging stimulus in the stimulus hierarchy.

Exhaustive research on the nature and measurement of anxiety has been done by Cattell (1957) who has formulated the following hypotheses concerning its nature:

Firstly, he says that anxiety derives from the innate response to threatening objects which becomes converted to the different introspective quality of "anxiety" through excitation by symbolic representation of punishments and deprivations in the real world. It is this symbolic representation which is considered to give anxiety a different quality from fear. Secondly, there is anxiety which derives from the contemplation of pleasure of symbolic ergic satisfactions. Such contemplation activates punishment signals and generates anxiety. The third hypothesis is that anxiety is caused by a possible loss of self-control and the fourth postulates that anxiety is generated by deflection strain, i.e., by long-circuiting of any goal satisfaction courses.

Luft (1957) has devised an Impulse Gratification Questionnaire which is related to Cattell's fourth hypothesis, i.e., deflection strain. Shippee-Blum (1959), using this questionnaire in studying delinquent personality, obtained results indicating a greater tendency for delinquents to be "anxious" in this regard, i.e., to exhibit psychopathological behavior. Anderson (1962) has also used the questionnaire

as an anxiety measure.

Harvey, Hunt and Schroder (1961) identify the individual's conceptual structure with the self. The self is the conceptual structure. They point out that the pervasiveness of anxiety probably results from real or expected refutation of concepts that were related due to lack of clear differentiation. They also postulate that anxiety which results from a threat to dedifferentiated concepts is probably greater than anxiety resulting from a threat to concepts that have never been clearly differentiated.

Dollard and Miller (1950) hold that all human behavior is learned and that all learning is the product of the same fundamental factors of drive, cue, response and reinforcement. They introduce the phrase "gradient of generalization" to explain why less similar cues (stimuli) or patterns of cues cause lesser generalization. They hold that there is a stronger tendency to respond to cues in proportion to their similarity to those present in the preceding situation in which the response was reinforced. Quite obviously, this theory is closely related to Wolpe's ideas of generalization of negatively conditioned stimuli which evoke anxiety responses.

Within the context of this paper, anxiety will be considered as being present when uncontrolled (autonomic) arousal is activated by a conditioned stimulus which may be of a symbolic sort.

Learning and Anxiety

In setting down his theory of behavior, Hull (1943), says that

all habits activated in a given situation combine multiplicatively with the total effective drive state operating at the moment to form excitatory potential. Response strength is determined in part by excitatory potential which varies as a result of drive state, known as anxiety. Consequently, in any situation evoking a single habit, the performance of a high drive subject should be greater than that of a low drive one. Although this postulation can be accepted on the basis of logic alone, very few tasks in real life require the evocation of a single habit and complex tasks evoke many habits in habit-family hierarchies.

Hilgard (1956) offers an interpretation which involves irrelevant learning and says that a subject under "high" anxiety learns things which interfere with his achievement on a complex task. This response interference view is also advocated by Mandler and Sarason (1952). This position may be reconciled with Hull's theory if it is true that in complex tasks the incorrect tendencies are stronger than the correct tendency. Since all tendencies are equally strengthened, the stronger incorrect responses then emerge.

Past research has shown a trend for "high" anxious groups to perform less satisfactorily than "low" anxious groups on tasks where numerous incorrect tendencies are aroused, i.e., complex tasks. Studies by Taylor and Spence (1952), Farber and Spence (1953), Montague (1953), Pickrel (1958), Castaneda, Palermo and McCandless (1956) have shown a significant inverse relationship between anxiety and performance. The results of all these studies support Yerkes-Dodson Law, which, in

essence, states that level of drive (anxiety) and performance are directly related until anxiety reaches an optimal level. Thereafter, an inverse relationship exists and level of performance begins to decrease when anxiety or drive level is increased beyond the optimal point.

Recently, however, researchers have found that this trend may not be due to anxiety alone, but may be a function of ego-involving threat and also of the relation between the task and the index of anxiety as measured by the instrument used. The relationship between anxiety and threat and performance has been intensively studied by Sarason (1961) and Van Buskirk (1961). Both found that "high" anxious groups perform as well as, or better than, "low" anxious groups as long as the experimental situation does not present a serious, ego-involving threat.

The relationship between the index of anxiety as yielded by the measuring instrument and performance has been studied by Sarason (1961). In a previous study, Sarason noted the interaction between scores on the Taylor Manifest Anxiety Scale, the Lack of Protection Scale, the Test Anxiety Scale and performance on the Word Association Test. When instructing his subjects that the Word Association Test was a sensitive personality instrument, the results showed that performance was more closely related to the anxiety measure given by the Taylor Scale. Repeating the experiment a second time, telling the subjects that the Word Association Test measured intelligence, the results showed a more positive relationship between the Test Anxiety Scale and performance. Sarason concluded that the closer the nature of the experimental stress is to the content of the anxiety items, the more predictive the items

are, i.e., the degree of predicted anxiety can be more accurately specified by manipulating the type of experimental stress. Apparently, then, anxiety that is the product of a specific situation can be more accurately measured by items pertaining to that situation. The Test Anxiety Scale contains items related to test situations only, and although this scale correlates with the Taylor Scale, it is reasonable to assume that the Test Anxiety Scale gives a more accurate index of anxiety in test situations, while the Taylor Scale yields a more general manifest anxiety measure.

At this point it should be mentioned that most of the studies concerned with the relationship between anxiety and learning have used a measure of anxiety obtained from the Taylor Scale. This scale was originally derived from the Minnesota Multiphasic Personality Inventory. The question arises as to what the scale actually measures. Does it measure a single general factor or several different factors of anxiety? What, if any, are the physiological correlates of such a measure?

Physiological Correlates of Anxiety

Berlyne (1960) when discussing Drive I, reports that indices of heightened arousal in the form of rarer alpha activity, reduced amplitude of the alpha waves when present, and lowered skin resistance have been shown to accompany at least one organic drive condition. Drive I is that notion of drive as a condition which affects the level of activity. It is drive in the Hullian sense. High Drive I and high arousal are both associated with restlessness, heightened activity of

the skeletal musculature, and general agitation. There appears to be an inverted U-shaped relation between arousal and efficiency. Furthermore, he regards Drive I and arousal as intimately related. Bexton, Heron and Scott (1954), while studying E. E. G. patterns of subjects under conditions of boredom found that delta waves (waves in the 1 - 3.5 cycles per second range) which are often present during sleep are absent during spells of anxiety and tension. Similarly, Vernon (1952) found that skin conductance, which Berlyne says is an index of arousal, was notably greater as boredom increased. These studies support Berlyne's theory that banal stimuli cause boredom, which in turn causes a rise in anxiety or arousal level. Although this study is not concerned with anxiety induced through boredom but with anxiety induced through symbolic meaning, nevertheless, the same physiological correlates are present.

Meyer and Noble (1958) found a positive interaction of tension (gripping a dynamometer) and anxiety (as measured by the Taylor Scale) in the learning of a verbal maze. Stennett (1957) while studying E. E. G. tracings under varying conditions of arousal found a curvilinear relationship between alpha amplitude and anxiety level. Stennett also noted that maximum alpha wave intensity appeared while conductance was at an intermediate level.

Schottstaedt (1960) studied the physiological correlates of anxiety and found that amounts of urine and creatinine increased as anxiety arose. Dykman _et_. _al_. (1959) found a positive relationship between G. S. R. and anxiety. Rudolf (1955) has found a relation between systolic blood pressure and anxiety in neurotics. He used overt

anxiety as his measure of anxiety and found that "high" anxious females had lower systolic pressures.

Written Anxiety Scales and G. S. R. Indices

Although physiological indices are accepted as the ultimate criterion of anxiety, there is little proof that a relationship exists between an index of anxiety yielded by the Taylor Scale and physiological reactions. Raphelson (1957) investigated the relationships among three dispositional and two physiological measures of anxiety. The dispositional measures were obtained from the Taylor Scale, the Test Anxiety Questionnaire and the Need Achievement Test. Physiological measures were G. S. R. and respiratory volume. He found that the Taylor Scale did not relate to conductance change, but the Test Anxiety Scale and Need Achievement Test did relate to G. S. R. but not to respiratory volume. Calvin *et. al*. (1956) found a product moment correlation of - .01 between anxiety scale scores and palmar perspiration index (N = 54). In another study, Beam (1955) also reports no significant relationship between palmar perspiration index and anxiety scale scores. Sarason (1960) summarizes these findings by saying that: "Measures of questionnaire-defined-anxiety such as the Manifest Anxiety Scale do not seem to relate consistently to physiological responding." Although there is little evidence to link G. S. R. with anxiety scores on paper-and-pencil tests, a more refined approach could yield such evidence.

Martin and McGowan (1955) studied the validity of the Sarason Test Anxiety Scale by noting differences in G. S. R. among high and low

scoring subjects as they discussed their feelings about test taking. They found that "high" anxious subjects showed significantly higher palmar readings that the "low" anxious subjects. They point out on the basis of these results that Sarason's Scale measures in part a general anxiety factor. It would seem likely, then, that if a factor analysis of the Taylor Scale yielded a general anxiety factor, that G. S. R. could be shown to be related to items which are most heavily loaded on that factor if experimental procedure similar to that used by Martin and McGowan was followed.

Factorial Studies of Anxiety Scales

There have been several factor analytical studies of the Taylor Manifest Anxiety Scale. O'Connor *et. al.* (1956) administered the Taylor Scale to two hundred and twenty university students. The tetrachoric correlations between forty-two of the items purporting to measure manifest anxiety were factored by the centroid method and rotated obliquely to simple structure. The five factors identified were called A) chronic anxiety or worry; B) a factor of increased physiological reactivity; C) sleep disturbances associated with inner strain; D) personal inadequacy; and E) motor tension. Bendig (1958) relates factors A, B and C found by O'Connor *et. al.* to the "neuroticism" factor identified by Eysenck, while D is related to Eysenck's "neuroticism and introversion" factors. Nishisato (1960) factored the Taylor Scale by the centroid method and used orthogonal rotation to identify four factors which were general anxiety, introverted anxiety, extraverted anxiety and inferiority

feelings.

A factorial study of the Test Anxiety Questionnaire was carried out by Sassenrath (1962). He did a principal components analysis of the intercorrelations obtained from scores on thirty-four items obtained on two hundred and two upperclassmen at University of California, Berkeley. A varimax rotation was then used on the unrotated factor loadings. Sassenrath extracted and interpreted seven factors which he identified as follows:

1. Confidence about individual intelligence testing.
2. Perspiring about testing.
3. Confidence during course examinations.
4. Confidence about group intelligence testing.
5. Heartbeat about testing.
6. Confidence before course examinations.
7. Avoidance of intelligence testing.

Although at first glance the factors extracted from the Taylor and Test Anxiety Scales do not appear closely related, there is evidence to suggest that the scales measure something common. For example, Sinick (1956) studied the correlation between the Taylor Manifest Anxiety Scale and the Sarason Test Anxiety. Using two hundred and ten university students as subjects, he found an r of .43. He also found that on each of the scales, the female mean was significantly higher than the male mean, a finding reinforced by Phillips and Jennings (1963). Similarly, Raphelson (1957) reports a correlation of .50 between scores on the Taylor and Test Anxiety Scales.

Mandler's Investigation of Autonomic Response to Threat

A study done by Mandler *et. al.* (1961) is of particular importance here for two reasons. Firstly, his experimental findings are important contributions in the study of physiological response and anxiety; secondly, the present study utilizes an experimental situation which closely resembles that used by Mandler.

Mandler was primarily interested in studying autonomic response to threat, but physiological response to anxiety and threat is different only in degree, not in kind. He did, however, administer the Taylor Manifest Anxiety Scale to the subjects (university students) in his study and investigated the relationship between Anxiety Scale scores and physiological response measures. Mandler found that G. S. R. measures correlated negatively with other physiological measures (E. K. G., peripheral blood flow and finger temperature.)

Mandler obtained physiological measures as the subjects responded to threatening stimulus items which he adapted from Heath (1960). He projected the items on a screen at fixed sixty second intervals and noted the response to each. He hypothesized that subjects would show evidence of a physiological reaction because of the conflictual nature of the threatening stimulus items. Interspersed with the threat items were neutral and blank items as well; the former were used to determine whether the threat items actually elicited a greater response than neutral items and the latter were used as a check on conditioning, i.e., to note whether subjects were actually responding to intended stimuli, and not to the clicking of the projector as it automatically changed

slides, or to the novelty of the stimulus material.

Although Mandler was very interested in verbal disorganization as an index of anxiety, the scope of this dissertation is limited to the relationship between physiological responses to stimulus items from anxiety scales. No attempt will be made to analyze relationships between physiological measures and verbal responses. However, several of Mandler's conclusions regarding physiological response, the validity of the Taylor Scale and the relationship between stimulus differences and physiological arousal are vitally important here.

Physiological Response. Mandler intercorrelated physiological measures taken during his experiment and found a consistent tendency for G. S. R. measures to correlate negatively with other physiological measures (E. K. G., peripheral blood flow, finger temperature) over all stimulus items. This prompted him to believe that the G. S. R. measure should be excluded in computing a general measure of physiological activity as indicative of a state of anxiety since it apparently indicated an aspect of activity which is different from the general visceral activity -- mainly cardiovascular in his study -- derived from the other measures.

It will be seen that although the present study only utilizes G. S. R. and E. K. G. measures, the above mentioned relationship was also found.

Validity of the Taylor Scale. Mandler concludes that his analysis suggests a distinction between two components of the anxiety syndrome:

activation and emotionality. He says that activation is associated with individual differences in the G. S. R. and scores on the Taylor Manifest Anxiety Scale. Emotionality, on the other hand, is associated with signs of verbal disorganization, situational awareness of bodily reactions, and physiological arousal in the cardiovascular sense, and not with G. S. R.

The fact that the Taylor Scale does not seem to measure situational variations in anxiety does not detract from the Scale's usefulness as a measure of general drive level; it was for precisely this reason that Taylor devised the scale, (Taylor, 1956), and Mandler's findings support her contention that the test is valid in this sense.

Stimulus Differences and Physiological Arousal. In his conclusions, Mandler states that all his measures of physiological response differentiated neutral from threatening stimulus items. He also found that the mean response to the blank stimuli was less than the mean response to neutral stimuli in all cases.

An investigation of this pattern of physiological responses to different stimuli (Threat-Neutral-Blank) was a primary aim of this dissertation. The inclusion of anxiety items, whose selection is described later, should show that these items elicit a degree of physiological response that will fall between that elicited by Threat and Neutral items. The rationale for this belief is based on the assumption that Anxiety items contain moderately conflictual material and should elicit, for a large group, moderate physiological response compared to Threat and Neutral items.

CHAPTER III

DEFINITIONS AND HYPOTHESES

Definitions

Anxiety - a state of arousal which is a conditioned response to stimuli in the environment. These stimuli can evoke the arousal response because of stimulus generalization from a conditioned stimulus which previously evoked a response that was negatively reinforced. It is to these stimuli that the individual is persistently and reactively hypersensitive.

Stimulus generalization - the process whereby stimuli similar to a stimulus which originally evoked a response acquire the capacity to evoke the same response.

Free Association - a cognitive activity in which the individual considers a given stimulus input within his present conceptual structure and verbalizes any spontaneous associations which occur.

Galvanic Skin Response (G. S. R.) - is a measure of the conductivity of the human skin: perspiration is an electrolyte and the resistance of the skin is inversely related to the amount of perspiration. Changes in resistance or conductance can be graphically recorded by a polygraph.

Electrocardiograph (E. K. G.) - is a graphic representation of

the rate of heartbeat obtained by measuring the potential difference between two points on the body due to the propogation of electrical energy originating at the heart.

Anxiety Scale - a paper-and-pencil measure of anxiety arrived at by counting the responses of the individual to items in the scale. (See discussion of measuring instruments, pp. 19-20 for detail.)

Hypotheses:

The main purpose of the present study is to attempt validation of written anxiety scales by a comparison of physiological responses to items which load on an anxiety factor. The first two hypotheses are related to this problem. Hypotheses 3, 4 and 5 relate to magnitude of physiological responses evoked by different stimulus material and the sixth hypothesis is simply an attempt to replicate oft-noticed differences in anxiety scale scores which are related to the sex of the respondents.

I. A "general Anxiety" factor can be extracted from a selected anxiety questionnaire.

II. "High" anxious subjects will give significantly different physiological response to anxiety items than "low" anxious subjects.

III. The physiological response to neutral items will be significantly less than the response to anxiety and threat items.

IV. The physiological response to threat items will be significantly greater than the physiological response to anxiety items.

V. The degree of physiological response to threat items is significantly related to the degree of physiological response to anxiety

items.

VI. Females will have a significantly higher mean score on the written test (anxiety scale) than males.

CHAPTER IV

EXPERIMENTAL DESIGN

Sample

Two samples from the same population (education students at the University of Alberta) were used. The first group consisted of one hundred and fifteen students who answered the selected anxiety questionnaire which is described below. Ideally, one sample would have sufficed, but temporal factors prevented use of one group. These students answered the questionnaire in March, 1963, and the item scores were intercorrelated for a factor analysis.

The second sample consisted of fifty-one volunteers, again education students, who were attending summer session in July and August, 1963.

Test Instruments Used

The anxiety questionnaire used was composed of thirteen items from the Luft Impulse Gratification Questionnaire, thirteen items from the Taylor Manifest Anxiety Scale and six items from the Test Anxiety Questionnaire. This questionnaire will henceforth be referred to as the selected anxiety questionnaire (S.A.Q.). It was decided to utilize the composite S. A. Q. because investigators have hypothesized and found correlations between the individual questionnaires and because more items relating to physiological responding were desired.

Items from the Test Anxiety Questionnaire were very suitable in

this regard, i.e., these items all refer to physiological reactivity to various test situations. Items from the Taylor Manifest Anxiety Questionnaire were selected on the basis of O'Connor's (1956) factor analysis. Unfortunately, O'Connor et. al. rotated obliquely and factor intercorrelations are not mentioned in his report. Because of this fact, the present writer selected those items which loaded most heavily on the first two factors (chronic anxiety or worry; physiological reactivity) for use in the S. A. Q.

Items were selected from the Impulse Gratification Scale in a random manner. The purpose of including these items is because the Impulse Gratification Questionnaire is intended to give a measure of ability for impulse control and is related to Cattell's fourth hypothesis that anxiety is caused by long-circuiting of goal-satisfaction courses. As mentioned previously, Shippee-Blum (1959) and Anderson (1962) have used the questionnaire to obtain measures of anxiety in their research and their findings lend support to the construct validity of the questionnaire.

Since almost all items from the Test Anxiety Questionnaire relate to physiological responding in test situations, six items were randomly selected for use in the S. A. Q.

A copy of the S. A. Q., with instructions, is included in Appendix (A).

The instrument used to obtain measures of physiological reactivity was a Grass Polygraph. This polygraph is one of the most recent models (Model 5D) and was obtained by the Division of Educational Psychology,

University of Alberta, in 1962. A description of the Grass Polygraph is given by Mandler (1958).

G. S. R. readings were measured in ohms of resistance. Deflection from base line per unit resistance change was adjusted by selecting an appropriate sensitivity level on the machine. The polygraph was calibrated for a 1 cm. deflection per 10,000 ohms change in resistance but when a subject's skin resistance varied too little to be recorded at this level the sensitivity was changed so that minute resistance variations caused greater pen deflections. This facilitated more accurate measurement of resistance changes.

E. K. G. readings involved only a measure of rate of heartbeat. Hence, a graphic representation of the heartbeat pattern with the time in seconds immediately above this pattern was all that was necessary. The writer was then able to calculate the number of beats increase after stimulus presentation (see G. S. R. and E. K. G. measures, pp. 23 - 24). A record of stimulus onset was provided by a marker which was synchronized to operate from a switch which changed slides in the projector.

Experimental Situation, Stimulus Items and Physiological Measurements

Environment circumstances were not perfect for this type of measurement. However, it was possible to overcome some major difficulties in this regard. Two adjoining rooms with separate entrances and of similar dimensions (15' x 8' x 10') were made available for the study. In the center of the dividing wall was a one-way screen through which an individual could see from the room of lesser illumination to the room of

greater illumination. Windows in both rooms were covered with black paper so that sunlight was eliminated and both rooms were in total darkness when artificial illumination was not used.

One room (henceforth referred to as the Viewing Room) contained a comfortable armchair. To the left armrest of this chair was attached a wooden support for G. S. R. electrodes which was so designed that two movable bolts permitted the experimenter to adjust the amount of pressure on the subject's palms in order to obtain maximum contact and comfort simultaneously. E. K. G. electrodes were attached to each forearm by means of a leather strap, similar to a watch strap.

Wires leading to the polygraph from the Viewing Room were passed through the wall into the second (Measurement) room in which the polygraph was located. Also in the Measurement Room were the slide projector and a tape recorder. The projector was situated close to the one-way screen through which the items were projected onto the wall in the Viewing Room. The tape recorder was used to obtain a double check on stimulus onset and also to obtain a record of any loud or unusual noises which could not be heard by the experimenter because of the insulated wall which separated the rooms.

Stimulus Items

Each individual was presented four types of items: threat, anxiety, neutral and blank items. Each subject responded to three threat items, three anxiety items, two neutral items and two blanks. With the exception of blanks which were identical in nature and order of

presentation (No. 2 and No. 9), the anxiety, threat and neutral items were randomly selected from their respective groups of items and were presented in random order so that the probability of two subjects receiving the identical items in the same order of presentation was very low. The total number of items in each category was: Threat (5); Anxiety (15); Neutral (6); and Blank (2).

Such randomization of presentation prevented bias due to adaptation effects and permitted analysis of group responses to groups of items. The selection of Anxiety items will be discussed in a later section in detail; Threat and Neutral items were selected from Mandler (1961) and Blank items were simply empty slide mounts. All items are contained in Appendix (D).

Physiological Measurements

The measures of autonomic activity taken were Galvanic Skin Response (G. S. R.) and Electrocardiograph (E. K. G.). Statistical analysis of data collected for these measures is a controversial topic; Woodworth (1938) considers the problem in detail and concludes that square root of conductance is normally distributed and is most adequate for statistical analysis. This was the G. S. R. measure used in this study.

The E. K. G. measure was the number of beats increase per minute that was induced by a stimulus presentation. Both measures are continuous interval variables, approximately normal in distribution and consequently are testable by parametric technique.

G. S. R.: The G. S. R. score for each subject is his mean shift in square root conductance ($\sqrt{c}$) for a particular type of item, i. e., Threat, Anxiety, Neutral or Blank. G. S. R. scores for a particular person on a particular type of stimulus item represent the mean difference between conductance level at stimulus onset and the maximum conductance level in the thirty seconds following stimulus onset. For example, the G. S. R. score for individual i on Anxiety stimuli would be the mean shift in $\sqrt{ci}$ on the three Anxiety items, so that:

$$\text{Score} = \sqrt{\frac{\sum_{j=1}^{K} C_{mij} - C_{bij}}{K}}$$

where C_{mij} = maximum conductance for person i on stimulus j.

C_{bij} = basal conductance for person i at onset of stimulus j.

K = number of stimulus presentations.

E. K. G.: The E. K. G. scores were calculated in a manner quite similar to that used to calculate G. S. R. scores. The mean shift in number of heartbeats per minute for a particular type of stimulus item constitutes the E. K. G. score. E. K. G. scores for a particular person on a particular type of item represents the mean difference between number of beats per minute during the fifteen seconds preceding stimulus onset and the number of beats per minute during the fifteen seconds following stimulus onset, so that:

$$\text{Score} = \sum_{j=1}^{K} \frac{(H_{mij} - H_{bij})}{K}$$

where: H_{mij} = number of beats per minute in fifteen seconds after stimulus onset.

H_{bij} = number of beats per minute in fifteen seconds before stimulus onset.

K = number of presentations of particular stimulus type.

Factorial Analysis for Identification of General Factor and Selection of Anxiety Stimulus Items

It was assumed that a factor analysis of the S. A. Q. would yield a general anxiety factor which accounted for the greatest amount of total variance. If the results were found to be compatible with the assumption, then items which showed highest loadings on that factor would constitute the anxiety stimulus items for subjects whose autonomic reactions were being measured.

Factor Analysis. Factor analysis is a numberical technique which permits consideration of several tests in terms of fewer dimensions than the actual number of tests. If a number of tests are administered to a group of individuals, and there is a high degree of correlation between the resulting test scores, then we assume that the tests are measuring something in common. This common variable is expressed mathematically as a factor. A factor is defined as a hypothetical variable common to several tests and the factor loadings express the correlation between the tests and the hypothetical variable represented by this factor.

The simplest mathematical model for describing a variable in terms of several others (factors) is a linear one. The complete linear expression for any variable $Z_j (j=1,n)$ for any individual i $(i=1,N)$

may be represented as follows:

$Z_{ji} = a_{j1}F_{1i} + a_{j2}F_{2i} + \ldots\ldots\ldots + a_{jm}F_{mi} + a_jU_{ji}$, where

Z_{ji} = standard score for person i on test.

a_{ji} = factor loading: the correlation between variable j and hypothetical variable m.

F_{mi} = factor score of person i on hypothetical variable m.

a_j = factor loading of test j on a unique hypothetical variable.

U_{ji} = standard score for person i on unique hypothetical variable j.

Identification of a factor, i.e., attaching a verbal label to the factor, is a matter of subjective judgment. However, the nature of the tests or items which correlate highly with the factor is usually the guide for identification.

Principal axis factor analysis. The method of factor analysis used in the present study was the principal axis method. This technique maximizes the contribution of the factors to the total variance and is especially suited to the requirements of this study since it yields the largest general factor which is mathematically possible from the obtained correlations.

The matrix of item intercorrelations obtained in the March, 1963, testing was subjected to a principal axis factor analysis. The computations were carried out by the IBM 1620 computer at the University of Alberta, using the Householder method of finding eigenvalues and eigenvectors.

The varimax factor rotation. In order to facilitate the

interpretation of factors thus obtained, analytical rotations were then carried out, using Kaiser's (1959) normal varimax technique. Since the writer was mainly concerned with a general factor that accounted for most of the total variance, he was concerned only with the nature and identification of the three largest factors. This permitted consideration of oblique factors which can lead to a more psychologically meaningful interpretation.

Preliminary Findings of the Factorial Study

In order to clarify subsequent discussion of data analysis, the results of the factorial study of the S. A. Q. will be discussed at this time. Since there is no statistical test of significance of a factor and also because subjective judgment enters into any factorial interpretation, the results can be presented at this time.

The S. A. Q. consists of thirty-two items whose selection has been described. It was administered to one hundred and fifteen first year education students at the University of Alberta in March, 1963. Responses to each item were recorded on a seven point scale and Pearson-product-moment intercorrelations were calculated. The matrix of item intercorrelations is shown in Table I. It will be noted that thirty-three variables are contained in the matrix. The thirty-third represents sex; the writer was interested in investigating relationships between item responses and sex of the respondent, so a dichotomous Male/Female classification numerically coded as zero or one was included for intercorrelations and factorial study.

TABLE I

S.A.Q. ITEM INTERCORRELATIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1. Sometimes open presents	---	008	097	099	-093	040	-021	073	070	008	-004	-001	075	-017	032	-036	-044	-048	017	066	039	125	-079	073	073	181	080	160	187	039	041	119	174
2. Say-sorry afterwards			206	224	295	103	001	266	113	050	-133	100	169	144	103	011	092	068	-007	143	220	129	215	213	255	131	251	294	241	195	040	210	111
3. Start-not finished				161	180	-170	-002	134	178	153	103	-031	273	-007	-042	-003	-153	-054	-044	002	305	000	032	226	102	-044	091	292	045	115	010	140	-364
4. Am easily bored					070	011	-001	147	023	-010	-105	023	215	-003	-057	-045	-017	-042	014	109	236	059	018	160	080	098	062	186	100	139	050	108	-015
5. Interested many things						183	126	119	191	-176	-110	098	201	-080	-195	-041	024	-098	058	085	157	-164	028	094	195	-014	049	027	068	136	198	172	-175
6. Attention clothes							179	-015	218	-177	-218	-008	-035	-006	-034	099	059	-051	170	282	-094	-130	-006	054	187	156	117	-046	228	171	191	062	156
7. Keep things self								020	092	-065	-065	-154	053	-174	-169	-016	-069	-113	-076	049	117	033	031	123	064	-064	104	-064	145	027	133	-018	-203
8. Lose temper easily									159	035	-131	031	077	185	133	079	032	112	155	209	168	208	133	132	075	139	070	258	321	065	112	318	025
9. Often excited										-172	-112	054	296	052	048	179	-008	-052	134	150	214	158	161	221	108	145	219	101	229	-009	200	160	231
10. Pretty poised											160	251	169	131	152	016	086	064	-030	-017	179	091	221	211	034	071	083	256	-033	-102	-070	044	005
11. School job marriage												107	-030	018	-015	-066	-178	-022	-042	-311	-029	029	-134	-202	-033	-208	-326	-140	-320	-278	-115	-085	-140
12. Stick job results													190	063	137	168	038	058	052	100	064	-020	068	167	167	089	-057	107	-045	150	056	056	-032
13. Likes change often														113	143	034	093	-068	-061	066	230	161	225	241	229	145	157	208	070	233	138	227	056
14. Group IQ perspire															874	518	696	637	350	066	048	107	458	100	125	250	232	073	175	099	089	254	118
15. Ind. IQ perspire																537	641	573	280	070	010	102	511	150	198	232	224	060	112	059	071	222	-112
16. Bef. ind. IQ heart																	499	707	530	241	065	033	216	184	182	294	297	052	284	201	203	270	096
17. Course exam perspire																		557	572	202	-008	061	487	089	062	305	273	074	273	185	140	334	-082
18. Group IQ heart																			467	112	-014	109	252	033	-029	199	146	003	165	124	155	189	-028
19. Bef. course heart																				398	-008	080	179	019	036	410	198	182	477	268	162	318	096
20. Worry money studies																					192	008	126	116	208	608	220	326	456	481	091	377	223
21. Blush often others																						246	171	632	312	146	351	343	234	158	224	421	091
22. Hands feet not warm																							160	086	088	072	114	053	177	-048	133	122	026
23. Sweat very easily																								334	013	255	270	099	012	166	081	160	-185
24. Easily embarrassed																									367	233	571	439	309	250	145	400	-022
25. More sensitive most																										393	276	382	382	286	108	302	171
26. Frequently worrying																											410	426	524	530	094	381	231
27. Unusually self-conscious																												435	416	375	146	355	052
28. Lack self-confidence																													518	522	124	482	103
29. Take things hard																														542	333	465	105
30. Worry misfortunes																															220	439	161
31. Dreams kept self																																341	100
32. Calm, not upset																																	130
33. Sex																																	---

The most striking of the intercorrelations contained in Table I appears to be the extremely low intercorrelations that exist between items taken from Luft's Impulse Gratification Questionnaire. These items are numbers one to thirteen in the matrix. Also, they do not correlate with items from the Test Anxiety Scale or Taylor Manifest Anxiety Scale; this lack of relationship within the Luft items and between the Luft items and items of the other scales is puzzling and somewhat disappointing. Sizable intercorrelations were obtained among and between items of the Taylor and Test Anxiety Scales.

The intercorrelation matrix was subjected to a principal axis factor analysis and the unrotated factor matrix is shown in Table II. This factor matrix contains only the three largest factors, i.e., those which account for most of the total variance.

A varimax rotation of this factor matrix was then done to facilitate identification. The factor loadings on the first three factors of the rotated factor matrix are shown in Table III. Inspection of these factors permitted identification of Factor I as chronic worry, Factor II as physiological reactivity in test situations and Factor III as over sensitivity or self-consciousness.

Although identification is facilitated by the varimax rotation, the results at this point were not considered to be psychologically meaningful, especially insofar as the design and plan of this study was concerned. It was expected that the first factor would show moderately high correlations with items from the Taylor and Test Anxiety Scales because such a structure would be expected on the basis of our

hypothesis. A second rotation permitting oblique factors was then used. The method used was that of extended vectors which was devised by Thurstone (1947).

The first step in applying the method is to obtain the extended values of the principal axis loadings. Extending the values of the loadings requires extending the vector of each variable so that it has a projection or loading of +1.00 on the first principal axis. These values were obtained by getting the reciprocal of the first principal axis loading of each item and multiplying all of the principal axis loadings in that row by the corresponding reciprocal.

This method is most appropriate for problems in which there are all high, positive loadings on the first principal axis factor. Extending the vectors in a three dimensional problem so that they have a projection of +1.00 on the first principal axis essentially gives the projection of the configuration on a plane perpendicular to the first axis. The plane intersects axis I at +1.00. This has the effect of showing the three dimensional configuration in two dimensions. If the vectors lie in three orthogonal planes, the projection would be an equilateral triangle. If they lie in oblique planes, the projection may be a triangle with unequal sides. The corners of the triangle represent the intersections of the planes, which is where the primary axes are placed and the co-ordinates of these corners are used to obtain the matrix Λ. Λ' and $(\Lambda')^{-1}$ are then obtained. $(\Lambda')^{-1}$ must then have its columns normalized by post multiplication by a diagonal matrix D in order to make the elements of $(\Lambda')^{-1}$ into direction cosines. The

TABLE II

UNROTATED FACTOR LOADINGS *+

		I	II	III	h^2_j
1.	Sometimes opens presents	126	186	069	055
2.	Say sorry afterwards	375	235	-201	236
3.	Start - not finished	154	317	-451	327
4.	Am easily bored	208	284	-159	149
5.	Interested many things	141	308	-012	114
6.	Attention clothes	191	132	499	302
7.	Keep things self	008	232	062	057
8.	Lose temper easily	359	087	-088	144
9.	Often excited	307	224	019	144
10.	Pretty poised	130	-071	-508	280
11.	School job marriage	-305	-163	-339	234
12.	Stick job results	165	-024	-220	076
13.	Likes change often	323	235	-387	309
14.	Group IQ perspire	542	-667	-207	781
15.	Ind. IQ perspire	515	-668	-243	770
16.	Bef. ind. IQ heart	567	-487	114	571
17.	Course exam perspire	578	-604	037	700
18.	Group IQ heart	448	-666	019	644
19.	Bef. course heart	546	-344	359	545
20.	Worry money studies	552	164	410	499
21.	Blush often others	439	402	-430	539
22.	Hands feet not warm	213	024	-188	081
23.	Sweat very easily	449	-314	-352	424
24.	Easily embarrassed	546	318	-387	549
25.	More sensitive most	465	285	-064	301
26.	Frequently worrying	672	056	277	531
27.	Unusually self-conscious	624	147	-055	414
28.	Lack self-confidence	591	398	-115	520
29.	Take things hard	696	231	364	670
30.	Worry misfortunes	600	249	260	489
31.	Dreams kept self	354	105	115	149
32.	Calm not upset	686	178	-041	503
33.	Sex	191	230	359	218
	Sums Squares	6.38	3.51	2.46	
	Per cent of Total Variance	19.3%	10.6%	7.45%	
	Per cent of Common Variance	51.7%	28.4%	19.9%	

* Items 1 to 13 from Impulse Gratification Questionnaire; Items 14 to 19 from Test Anxiety Scales; Items 20 to 32 from Taylor Scale; Item 33 represents sex.

\+ Eleven factors were rotated by Varimax technique. All eleven unrotated factors are given in Appendix (F) so that replication may be done by others.

TABLE III

FACTOR LOADINGS AFTER VARIMAX ROTATION

		I	II	III	h^2_j
1.	Sometimes opens presents	079	001	056	009
2.	Say sorry afterwards	074	-070	-268	082
3.	Start - not finished	-003	077	-277	082
4.	Am easily bored	134	056	-035	022
5.	Interested many things	021	115	-036	014
6.	Attention clothes	209	012	015	044
7.	Keep things self	-080	179	-280	116
8.	Lose temper easily	201	-125	025	056
9.	Often excited	083	-032	-115	021
10.	Pretty poised	008	-069	-292	090
11.	School job marriage	-396	-014	136	175
12.	Stick job results	078	-066	-000	010
13.	Likes change often	051	-048	-201	045
14.	Group IQ perspire	-014	-902	-088	821
15.	Ind. IQ perspire	-053	-885	-146	807
16.	Bef. ind. IQ heart	218	-711	-081	559
17.	Course exam perspire	232	-790	005	677
18.	Group IQ heart	096	-795	061	644
19.	Bef. course heart	542	-507	187	585
20.	Worry money studies	785	-050	009	618
21.	Blush often others	081	055	-655	438
22.	Hands feet not warm	-056	-092	-107	023
23.	Sweat very easily	066	-482	-263	305
24.	Easily embarrassed	142	-068	-827	708
25.	More sensitive most	156	-075	-516	296
26.	Frequently worrying	727	-242	-190	623
27.	Unusually self-conscious	331	-231	-684	630
28.	Lack self-confidence	570	031	-484	560
29.	Take things hard	668	-143	-254	531
30.	Worry misfortunes	726	-061	-214	576
31.	Dreams kept self	124	118	-094	038
32.	Calm, not upset	456	-242	-287	348
33.	Sex	358	138	065	151
	Sums Squares	3.66	4.19	2.87	
	Per cent of Total Variance	11.1%	12.7%	8.7%	
	Per cent of Common Variance	34.2%	39.1%	26.7%	

structure on the primary factors is then given by,

$$F\,(\Lambda')^{-1}D$$

These factors and the item loadings are shown in Table IV. The transformation matrix $(\Lambda')^{-1}D$ is shown in Table V. The F matrix which is postmultiplied by the transformation matrix is, of course, the same as the unrotated matrix in Table II.

The resulting structure on the primary is now more complex, in the sense that the factors are intercorrelated. The intercorrelations were found by premultiplying the transformation matrix by its own transpose. The resulting matrix contains the intercorrelations as is shown in Table VI. From this table, it is obvious that Factors A and B are quite highly intercorrelated; this permits interpretation of A and B as having much in common. Perhaps this interpretation based upon structure on primaries is more meaningful psychologically because factors A and B may now be considered as interrelated dimensions of a general anxiety factor.

This assumption is supported by the loadings of the items on the three factors. Factor A might be interpreted as Anxiety which shows high loadings by "worry" and "heartbeat" items; Factor B as Anxiety which shows a similar pattern of loadings except that the "intr vert-sensitivity" items now show appreciable loadings.

It can be seen that although some test anxiety items (16, 17, 19) do show appreciable loadings on Factor A, they load most highly on Factor C which is not correlated with Factor A. This lends support to the findings that the Test Anxiety Scale does give some indication of

TABLE IV

FACTOR LOADINGS AFTER OBLIQUE ROTATION BY METHOD OF EXTENDED VECTORS: STRUCTURE ON PRIMARY AXES

		A	B	C
1.	Sometimes opens presents	065	213	-102
2.	Say sorry afterwards	013	241	-095
3.	Start - not finished	-328	019	011
4.	Am easily bored	-038	197	-038
5.	Interested many things	055	258	-154
6.	Attention clothes	525	475	-187
7.	Keep things self	-001	179	-194
8.	Lose temper easily	107	208	157
9.	Often excited	185	319	-014
10.	Pretty poised	-329	-259	313
11.	School job marriage	-446	-468	016
12.	Stick job results	-103	-045	013
13.	Likes change often	-175	105	138
14.	Group IQ perspire	127	-205	868
15.	Ind. IQ perspire	030	-242	868
16.	Bef. ind. IQ heart	408	101	631
17.	Course exam perspire	357	-006	628
18.	Group IQ heart	271	-129	733
19.	Bef. course heart	605	315	410
20.	Worry money studies	634	652	015
21.	Blush often others	-158	246	-089
22.	Hands feet not warm	-053	033	164
23.	Sweat very easily	-061	-130	610
24.	Easily embarrassed	-062	282	215
25.	More sensitive most	177	401	054
26.	Frequently worrying	585	579	207
27.	Unusually self-conscious	272	412	239
28.	Lack self-confidence	193	512	046
29.	Take things hard	667	746	-072
30.	Worry misfortunes	528	641	032
31.	Dreams kept self	282	333	065
32.	Calm, not upset	314	478	213
33.	Sex	401	453	207

TABLE V

TRANSFORMATION MATRIX $(\Lambda')^{-1}D$

518	576	-529
-035	597	757
864	574	374

TABLE VI

OBLIQUE FACTOR INTERCORRELATIONS *

	A	B	C
A	1.00		
B	.773	1.00	
C	-.007	.362	1.00

* Obtained by premultiplication of the transformation matrix $(\Lambda')^{-1}D$ by its own transpose.

general anxiety but is also a good measure of specific anxiety in test situations. The pattern on the primary axes ($F\Lambda D^{-1}$), which meets the simple structure criterion, is given in Appendix (E). It will be noted that no differences in interpretation are determined by the pattern.

For the purposes of this study, items which showed appreciable loadings on Factors A or B, i.e., items with loadings of .30 or above, were selected as those which measure a general anxiety factor. These items are listed in Appendix (D). Most of them are from the Taylor Scale and, for the present, may be assumed to give some indication of general drive level as Taylor (1956) claims.

The next step is to describe the experimental situation and to report the data analysis and the results of hypotheses testing: a definite trend becomes obvious using the techniques which have been discussed.

Description of Experimental Situation

Each subject was greeted cordially and the experimenter tried to make him feel at ease by engaging in a friendly discussion concerning the weather and other non-threatening topics. During this time, the subject was asked to sit in a very comfortable armchair and electrodes were attached to his forearms and to the palm of his right hand. The experimenter continued to offer verbal reassurance. When the subject seemed to have adjusted to the room and the novel situation, the instructions were read to him. The instructions were as follows:

> "In a few moments I am going to turn off the light and leave this room. You will have nothing to do for about ten minutes, so just relax and take it easy. After a while, some phrases and sentences will be projected on the wall in front of you. Read

> each phrase or sentence aloud and then say the first thing that comes to your mind.
>
> Also, there will be some blank slides and pictures of playing cards projected on the wall. When this happens, just say, 'It's a blank,' or 'It's a card' or something similar.
>
> Do you have any questions? (Here the experimenter reviewed the instructions until the subject was satisfied he understood what he was to do.)
>
> O. K. then, let's begin!"

The blank slides were used as a check on conditioning as suggested and used by Mandler (1961). Between fifteen and thirty blanks or pictures or playing cards were projected during the first stages of actual viewing; this was done to extinguish autonomic reactions to the novel stimuli and to permit the subjects to adapt to the situation.

Raw data for all subjects are included in Appendix (B) in unscaled form. Data presented in tables within the body of this paper have been scaled as follows:

G. S. R. measures were all scaled by 10^{+4}, so that a mean G. S. R. score of 686.3 as reported in Table VII is .06863 in raw score form, i.e.,

$$\sqrt{\sum_{j=1}^{K} \frac{C_{mij} - C_{bij}}{K}} = .06863$$

E. K. G. measures were all scaled by 10^{+2}, so that a mean E. K. G. score of 459.2 as reported in Table VII is 4.592 in raw score form, i.e., $\sum_{j=1}^{K} \left(\frac{H_{mij} - H_{bij}}{K}\right) = 4.592$. Data were scaled to facilitate computation.

Subjects answered the S. A. Q. either before or after the viewing session was completed. The order was randomized over subjects in order to prevent a consistent bias which could occur if all subjects responded before or after the viewing time ended.

STATISTICAL ANALYSIS

Tests of Significance

Mean differences. The significance of differences between means was tested by the use of one and two-tailed "t" tests for the significance of differences of uncorrelated means, using the forumula,

$$t = \frac{\bar{X}_1 - \bar{\bar{X}}_2}{Sx_1 - x_2}$$

The .05 level of significance was used to set the rules of behavior for determining whether a hypothesis was accepted or rejected. In order to facilitate interpretation, the a posteriori use of one-tailed tests of significance has been utilized to clarify the difference in one direction. Since clarity is a necessity in scientific reporting, this technique need not be considered intrinsically wrong as long as it facilitates interpretation.

Correlation Coefficients. Ferguson (1959, p. 153) suggests the use of the formula,

$$t = r\sqrt{\frac{N - 2}{1 - r^2}}$$

to test whether or not an observed correlation coefficient differs significantly from zero. This method was used in the present study. The number of degrees of freedom associated with this expression is N -2, since the correlation coefficient is the slope of a regression line in standard score form, and the number of degrees of freedom associated with fitting a straight line to any number of points is always equal to two less than the total number of points involved.

CHAPTER V

RESULTS OF THE STUDY

The results of this study are presented in three sections within this chapter. The following three sections represent three aspects of the total thesis problem:

1. Anxiety scale scores and physiological response to anxiety stimulus items.
2. Examination of group mean physiological responses to the different types of stimulus items.
3. Analysis of sex differences in responding to the anxiety scale.

Anxiety Scale Scores and Physiological Response

The total group of volunteers for physiological measurements consisted of fifty-one subjects. Of this number, data for the first twelve subjects were eliminated from data analysis because these subjects were not given sufficient time to adapt to the novel situation. This left a sample of thirty-nine.

The thirty-nine subjects were classified as either "high" or "low" anxious depending on whether or not their score on the S. A. Q. fell above or below the median score for the group. Mean G. S. R. and E. K. G. scores were calculated for each subject and each group. The data in tabulated form are shown in Table VII.

Two facts are immediately obvious from this table; firstly, the

TABLE VII

MEAN PHYSIOLOGICAL MEASURES OF "HIGH" AND "LOW" ANXIOUS SUBJECTS ON STIMULUS ITEMS *+

		Threat	Anxiety	Neutral	Blank
Low Anxious N = 20	G.S.R. E.K.G.	606.25 683.4	547.1 487.4	508.1 451.7	334.5 251.5
High Anxious N = 19	G.S.R. E.K.G.	459.2 493.9	400.9 408.9	337.0 354.36	253.8 248.4

* G.S.R. measures scaled by 10^{+4}

* E.K.G. measures scaled by 10^{+2}

+ These measures are scaled similarly in all subsequent tables unless otherwise specified.

TABLE VIII

TESTS OF SIGNIFICANCE OF DIFFERENCE BETWEEN DIFFERENCES IN G.S.R. AND E.K.G. RESPONSES TO NEUTRAL AND ANXIETY ITEMS BY "HIGH" AND "LOW" ANXIOUS SUBJECTS *

Group		Neutral	Anxiety	Diff.	D	S. est.	t	Sig.
Low Anxious	G.S.R.	508.1	547.1	39	24.9	190.2	.29	N.S.
High Anxious		337.0	400.9	63.9				
Low Anxious	E.K.G.	451.7	487.4	35.7	18.8	284.5	.15	N.S.
High Anxious		354.4	408.9	54.5				

*This table was included to permit comparison of difference in magnitude of change by "high" and "low" anxious subjects to neutral and anxiety stimulus items. Differences between differences are not significant, for G.S.R. or E.K.G. measures.

TABLE IX

MEAN PHYSIOLOGICAL VALUES FOR "HIGH" AND "LOW" ANXIOUS SUBJECTS TO ANXIETY STIMULUS ITEMS

Group	Measure	$\bar{X}$	Difference	"t"	Significance
Low Anxious	G.S.R.	547.1	146.2	2.70	Sig.
High Anxious	G.S.R.	400.9			
Low Anxious	E.K.G.	487.4	78.9	.964	N.S.
High Anxious	E.K.G.	408.5			

assumption that anxiety items would evoke a moderate degree of arousal is supported by the group means of physiological responses to the different types of items. Secondly, the "low" anxious subjects show higher mean values than "high" anxious subjects in all corresponding cells.

Hypothesis II

The hypothesis that "high" anxious subjects would give significantly different physiological response to anxiety items than "low" anxious subjects was tested by using a two-tail "t" test for the significance of differences between means. Table VIII contains the data in summary form. A two-tail "t" test showed a significant difference to exist between G. S. R. means ($t=2.70$, $df=37$, $p \angle .02$) so a one-tail "t" test was also used to clarify the difference in one direction ($t=2.70$, $df=37$, $p \angle .01$).

As mentioned previously, the "low" anxious group gave higher mean physiological response to all stimuli than did the "high" anxious group to similar types of stimulus items. In the case of E. K. G. response to anxiety items, the mean difference is not significant. This finding is not necessarily contradictory as Sarason (1960) points to the existence of intra-individual variations in physiological responding, and Mandler (1961) refers to an apparent difference between G. S. R. and cardiovascular measures.

Also, the fact that "low" anxious subjects showed higher mean physiological response than "high" anxious subjects can be explained in

terms of the kinds of measuring techniques that were used in this study. It should be remembered that changes in physiological responding irrespective of base level were utilized; a measure which is expressed as a ratio of change/base level could conceivably show a quite different pattern of response. The square root of conductance change does not include this ratio, nor does the E. K. G. measure.

Analysis of Physiological Responses to Different Kinds of Stimulus Items

The assumption that anxiety items would evoke physiological responses greater than the response to neutral but less than the response to threat items was supported by the findings. All differences are not statistically significant, but the trend for larger mean values to be in the expected direction is consistent. Total group mean responses are shown in Table X.

TABLE X

MEAN PHYSIOLOGICAL RESPONSES OF TOTAL GROUP
TO STIMULUS ITEMS
(N = 39)

	G.S.R.	E.K.G.
Threat	534.6	591.1
Anxiety	475.9	449.2
Neutral	424.7	404.3

Hypothesis III

The hypothesis that physiological response to neutral items would be significantly less than the physiological response to anxiety and threat items was tested by a one-tail "t" test for the significance of differences between means. The findings are shown in Table XI.

The differences between physiological responses to neutral and anxiety items are not significant; however, the differences between physiological responses to neutral and threat items are significant.

TABLE XI

SIGNIFICANCE OF DIFFERENCES BETWEEN MEAN PHYSIOLOGICAL RESPONSES TO STIMULI

		$\bar{X}$	difference	S^2	Se difference	t	Significance
GSR	Anxiety	475.9	51.2	35710.7	45.7	1.12	N.S.
	Neutral	424.7		45875.2			
EKG	Anxiety	449.2	34.9	66637.8	63.5	.55	N.S.
	Neutral	404.3		90665.1			
GSR	Threat	534.6	109.9	52784.6	50.3	2.184	Significant
	Neutral	424.7		45875.2			
EKG	Threat	591.1	186.8	59585.6	62.1	3.01	Significant
	Neutral	404.3		90665.1			

Hypothesis IV

The hypothesis, that the physiological response to threat items would be significantly greater than the physiological response to

anxiety items, was also tested by a one-tail "t" test. The findings are shown in Table XII.

TABLE XII

SIGNIFICANCE OF DIFFERENCES BETWEEN MEAN PHYSIOLOGICAL RESPONSES TO ANXIETY AND THREAT STIMULI

		$\bar{X}$	$\bar{X}_t - \bar{X}_a$	Se difference	t	df.	Significance
G S R	Threat	534.6	58.7	47.6	1.23	38	N. S.
	Anxiety	475.9					
E K G	Threat	591.1	141.9	57	2.49	38	Significant
	Anxiety	449.2					

Although the difference between G. S. R. means is not significant, the mean difference between E. K. G. measures is highly significant. These findings partially support the hypothesis, but it is difficult to state unequivocally that anxiety items evoke a significantly greater amount of physiological response than neutral items (Hypothesis III).

This is undoubtedly due to the fact that anxiety items are not as universally conflictual for the individual attending university in our Canadian culture as are threat items; however, there is a definite tendency for the anxiety stimuli to evoke greater physiological response than neutral stimuli which does indicate an intermediate level which was hypothesized.

Hypothesis V

This hypothesis, that there would be a significant relationship between the degree of physiological response to anxiety and threat items, was tested by studying the significance of the correlation coefficient which expresses the relationship. The correlation between G. S. R. and E. K. G. scores on anxiety and threat stimuli was calculated. The values obtained were .861 for G. S. R. and .360 for E. K. G.

Both are significantly different from zero beyond the .05 level and the correlation coefficient of .861 which expresses the relationship between mean G. S. R. responses to anxiety and threat items, shows that G. S. R. measures of response to these items vary together quite closely and regularly. The E. K. G. measures do not show such a high degree of covariation which leads one to suspect that Mandler (1961) was correct when he postulated a difference to exist between G. S. R. and cardiovascular measures.

This fact is further illustrated by correlational data on the various G. S. R. and E. K. G. measures.

TABLE XIII

CORRELATIONS BETWEEN G. S. R. AND E. K. G. MEASURES

			1	2	3	4
G.S.R.	Anxiety	1	1.000			
	Threat	2	.861	1.000		
	Neutral	3	.846	.662	1.000	
	Blank	4	.669	.530	.666	1.000
			1	2	3	4
E.K.G.	Anxiety	1	1.000			
	Threat	2	.360	1.000		
	Neutral	3	.504	.658	1.000	
	Blank	4	.281	.026	.094	1.000

Analysis of Sex Differences in Responding to the Anxiety Scale (S.A.Q.)

Hypothesis VI

This hypothesis, that females would score significantly higher on the written anxiety scale than males, was tested by the conventional one-tail "t" test for the significance of difference between means. Relevant data are shown in Table XIV.

TABLE XIV

MEAN SCORES ON S. A. Q.

	$\bar{X}$	S^2	Se diff.	df	t	Significance
Males	122.36	425.87	2.44	311	1.79	Significant
Females	126.73	504.02				

The mean difference of 4.37 is statistically significant at the .05 level using a one-tail test. The one-tail test is used here because a difference was predicted in one direction. This finding supports the work of Phillips and Jennings (1963) and Sinick (1956). It should also be noted that the present study has utilized a large sample (N = 313) which reduces the probability of sampling error being the cause of observed differences.

Furthermore, the apparent unrelatedness of items from the Luft Questionnaire makes it highly probable that these items would not lend themselves to a consistent pattern of response, at least for subjects of this university population. It seems very likely, then, that females of this population do tend to score higher on written anxiety scales, at least those which measure test anxiety and general drive level (Taylor Scale).

CHAPTER VI

SUMMARY OF FINDINGS AND IMPLICATIONS FOR FURTHER RESEARCH

Summary of Findings

The S. A. Q. which has been previously described, was used as a paper-and-pencil measure of anxiety for a sample of university students. The intercorrelations between items were factored by the principal axes method in an attempt to identify a general anxiety factor so that:

a) The results of this study could be compared with those of similar studies involving factorial structure of the Taylor Scale, and

b) Items which showed high loadings on a general anxiety factor could be used as anxiety stimuli while physiological measurements of G. S. R. and E. K. G. were being taken.

The unrotated factor matrix contained three factors which appeared relevant. Their particular relevance is explained by the fact that the principal axis method of factoring yields factors in descending order of amount of variance accounted for and it was likely that any "general" factor would be one of the first three. Inspection of these unrotated factors indicated that some items showed rather high loadings on two factors.

A varimax rotation was then performed to facilitate identification. The factor loadings of the rotated factor matrix permitted identification of Factor I as chronic worry, Factor II as physiological reactivity in test situations and Factor III as over-sensitivity or self-consciousness.

These findings are quite compatible with those of O'Conner (1956) and Nishisato (1960) who found very similar factors in their analyses.

At this point a subjective decision was made regarding rotation; the orthogonal rotation yielded factors which were uncorrelated and mathematically meaningful but it was felt that the unrotated factor matrix could be rotated obliquely in such a way that the resulting structure would yield correlated factors which would lend themselves better to identification of a general anxiety factor. The oblique rotation was done by the method of extended vectors and the resulting structure showed that:

Factor A could be interpreted as an anxiety factor which shows high loadings by "worry" and "heartbeat" items.

Factor B was very similar to Factor A, except that the "introvert-sensitivity" items showed high loadings as well.

Factor C was a test anxiety factor.

The correlation between Factors A and B was .773 and it was decided that these two factors might be considered as two components of a general anxiety factor. This decision was made because of the high correlation between them and also because Factor A includes some test anxiety items with high loading even though Factor C appears as a test anxiety factor which is uncorrelated with A.

It is difficult to state succinctly and parsimoniously exactly why one structure is "better" than another; both the orthogonal and oblique factors blend well with previous findings which is valuable knowledge in itself. However, it was decided that the oblique factors

A and S, which are highly intercorrelated aspects of what is generally considered to "pervasive" or "general" anxiety, would constitute the general anxiety factor in this study. Other interpretations may prove to be more useful; indeed, it appears that greater refinement is necessary in psychologists' thinking about anxiety and that some certainty in this specificity of thought might be reached in studies of this type.

One final point might be made here regarding the Luft Impulse Gratification Questionnaire. Items from this questionnaire did not seem to intercorrelate with each other or with items from the Taylor and Test Anxiety Scales. It may well be that the questionnaire is useful with people who have extreme psychopathological tendencies: this would be quite possible because a sample of university students is not likely to exhibit these tendencies. They are conforming, future-oriented, industrious persons. Hence, one cannot state that the test is not useful for all groups although its utility with university students may be questionable on the basis of findings in this study.

The hypothesis that "low" anxious subjects would show significantly different physiological response to anxiety items than "high" anxious subjects was supported by differences in means of G. S. R. and E. K. G. responses. The G. S. R. means were statistically significant whereas the E. K. G. means were not. The non-significance of the difference between E. K. G. means may be in part attributed to the great variability in cardiac response when compared to G. S. R. response, although both measures were scaled so as to be comparable in raw form. This fact may lend itself well to Mandler's (1961) suggestion that

anxiety is of two types, i.e., activation which is associated with individual differences in the G. S. R. and scores on the Taylor Scale and emotionality which is associated with situational awareness of bodily reactions and physiological arousal in the cardiovascular sense, not G. S. R.

It would appear then, that the Taylor Scale is valid in the sense that it measures activation level of which G. S. R. is a good indicator. The findings here suggest that this is indeed so and that the Taylor Scale does discriminate along this activation dimension. On the other hand, emotionality, which is associated with cardiac arousal, seems to be much more variable and the Taylor Scale does not discriminate as well in this regard. The duality of anxiety is made more complex because it is highly probable that both dimensions can exist simultaneously in an individual; this would account for the highly intercorrelated oblique factors A and B.

Another complication which cannot be disregarded lightly is the type of G. S. R. and E. K. G. measure that is used. The observation that "low" anxious subjects showed greater change in physiological response can be attributed to the fact that the "low" anxious subjects had lower base levels from which change could occur. This is most striking when one considers G. S. R. measures: the E. K. G. measures show much greater variability, i.e., base level of E. K. G. does not appear to be as reliable a determiner of change as is base level of G. S. R. Once again though, the Taylor Scale is valid in the sense that it will discriminate base levels, particularly of G. S. R. It must

also be said that the G. S. R. and E. K. G. mean responses to threat items by "high" and "low" anxious groups are both significantly different from each other despite the greater variability of E. K. G. measures. These data, though not relevant to a specific hypothesis, are included in Table XV for purposes of classification.

TABLE XV

PHYSIOLOGICAL RESPONSE OF "HIGH" AND "LOW" ANXIOUS SUBJECTS TO THREAT ITEMS

		$\bar{X}$	N	Difference	t	Significance
G.S.R.	Low Anxious	606.25	20	147.04	2.04	$p < .025$*
	High Anxious	459.21	19			
E.K.G.	Low Anxious	683.4	20	189.5	2.53	$p < .01$*
	High Anxious	493.9	19			

*One-tail "t" tests used

It is obvious from this table that threat items seem to evoke greater mean differences in E. K. G. response than anxiety items. This supports the research which shows that threat is an important variable which influences performance of "high" and "low" anxious subjects. It also speaks well for the fact that "high" and "low" anxious groups can be discriminated by a paper-and-pencil test of anxiety.

Analysis of mean physiological responses to the different types of stimuli over the total group permitted the writer to draw several conclusions which supported the assumptions made earlier in the study.

The differences between mean physiological (G. S. R.; E. K. G.) responses to threat and neutral items were highly significant and there is little doubt that threat items do induce greater arousal than neutral items.

The differences between mean responses to anxiety and neutral items are not statistically significant, but are in the expected direction with the G. S. R. difference being greater. The differences between mean responses to anxiety and threat items indicate that threat items differentiate at a statistically significant level for E. K. G. measures ($p < .01$) but not for G. S. R. measures. Once again the variable of threat appears to exert a very important influence on cardiac arousal.

The correlation between G. S. R. scores on anxiety and threat stimuli was .861 which indicates a high degree of relationship. The corresponding E. K. G. correlation is a much lower, though significantly different from zero (.360). These coefficients support the fifth hypothesis and indicate the E. K. G. variability that is a result of threat and the emotionality component of anxiety.

Finally, there seems to be little doubt that sex differences in responding to written anxiety scales do exist. Females in this study had a significantly higher mean score ($p < .05$) on the S. A. Q. than males. This finding supports the studies of Sinick (1956) and Phillips and Jennings (1963).

Implications for Further Research

General

The most obvious implications for further research are in the areas of a component analysis of anxiety into activation and emotionality. The former may be related to general drive level and G. S. R. and the latter to specific anxiety which seems characterized by great changes in heart functioning due to situational awareness of anxiety. A more sensitive written test has to be devised to better discriminate people along these dimensions and the resulting discrimination has to be verified by physiological responding in an experimental situation.

It would also be advisable to include respiratory and cardiovascular measures such as dermal temperature and blood pressure if the equipment is available. A variety of G. S. R. and E. K. G. measuring techniques could be employed to check the adequacy of each to mathematical and psychological criteria. A discriminant function analysis might then be used to obtain the best weighted combination of measures for maximum differentiation between experimental and control groups.

Also, a research project is needed to study the relationship between base level of G. S. R. and E. K. G. and change in these levels as stimuli become increasingly threatening. If curves were plotted for different base levels, it would be possible to explore individual behavior more accurately in relation to a group functioning at the same level or at different levels.

A sensitive factorial study which attempts to show the

relationship between factor scores and physiological and/or psychological responding would be valuable. It might be suggested here that time be taken to select an adequate questionnaire. More items are needed relating to situational cardiac arousal which are more subtle variations of Test Anxiety Questionnaire Items.

Studies of self-perception and modes of responding might be undertaken. It is possible to detect subjects who perspire very freely and yet have not checked items relating to this fact on the questionnaire. This leads to interesting hypotheses in the areas of self-concept, authoritarianism and extraversion-introversion. Block (1957) has done some work in this area and it seems quite fruitful.

Education

The questionnaire development and validation are urgently needed. Similarly, the investigation of cardiac functioning and arousal is important. It may be possible to identify high energy consumers on the basis of factor scores as well as those children who are liable to extreme changes in heart functioning under threatening conditions.

If a general drive-specific anxiety duality can be validated, the relation of each to cognitive functioning under varying conditions of task difficulty, intelligence, age, threat and motivation can be more adequately studied. These same ideas could be applied to teachers and teacher trainees at university with the dependent variable of teacher effectiveness. The criterion for the latter, though difficult to specify, might constitute a summary student teaching report for trainees at

university where such reports are carefully done and various aspects of the total teaching performance are evaluated separately.

For the present, it might be best to concentrate on the development of a more sensitive anxiety scale in an attempt to produce one which yields more valid and distinct activation-emotionality components.

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APPENDIX A

THE SELECTED ANXIETY QUESTIONNAIRE

Name____ Class ______________________________

This questionnaire is designed to give you an opportunity to express your feelings in regard to different situations and experiences. The value of this questionnaire will in large part depend on how frank you are in stating your opinions, feelings and attitudes. Needless to say, your answers to the questions will be kept strictly confidential; they will under no circumstances be made known to any instructor or official of the university.

We are requesting you to give your name and class only because it may be necessary for research purposes.

For each question there is a scale on the ends of which are statements of opposing feelings or attitudes. You are required to put a mark (X) on that point of the scale which you think best indicates the strength of your feeling or attitude about the particular question. Do not hesitate to put the mark at any point on the scale as long as that mark reflects the strength of your feelings or attitude.

If you have any questions, please ask the person who has passed out the questionnaire.

THERE ARE NO "CATCH" QUESTIONS ON THIS QUESTIONNAIRE. PLEASE READ OVER EACH QUESTION AND EACH SCALE VERY CAREFULLY. THERE IS NO TIME LIMIT.

EXAMPLE: I like eating candy. __1__2__3__4__5__6__7
Never Always

If you hate candy and never eat it, put the (x) in the first blank.
If you eat it once in a while, the second or third blank should contain the (X)
If you eat candy quite frequently, put the (X) in the fifth blank.
If you love eating candy and eat it whenever you can, put the (X) in the seventh blank.

NEVER ALWAYS

1. I sometimes open presents before I'm supposed to __1__2__3__4__5__6__7

2. I frequently say things I'm sorry about afterwards __1__2__3__4__5__6__7

3. I frequently start new projects without waiting to finish what I have been doing __1__2__3__4__5__6__7

4. I am easily bored. __1__2__3__4__5__6__7

5. I am interested in too many things. __1__2__3__4__5__6__7

6. I pay too much attention to my clothes __1__2__3__4__5__6__7

7. I tend to keep things to myself most of the time __1__2__3__4__5__6__7

8. I lose my temper easily. __1__2__3__4__5__6__7

9. I am often excited or thrilled __1__2__3__4__5__6__7

10. I am a pretty poised person __1__2__3__4__5__6__7

11. I feel that a person should be through school and established in a job before thinking seriously of marriage. __1__2__3__4__5__6__7

12. I stick at a job even though it seems I am not getting results __1__2__3__4__5__6__7

13. I find that my likes and dislikes change very frequently. __1__2__3__4__5__6__7

Not at All Freely

14. While taking a group IQ test, to what extent do you perspire? __1__2__3__4__5__6__7

15. While taking an individual IQ test, to what extent do you perspire? __1__2__3__4__5__6__7

16. Before taking an individual IQ test, to what extent do you experience accelerated heartbeat? __1__2__3__4__5__6__7

17. While taking a course exam, to what extent do you perspire? __1__2__3__4__5__6__7

18. While taking a group IQ test, to what extent do you experience accelerated heartbeat? __1__2__3__4__5__6__7

19. Before taking a course exam, to what extent do you experience accelerated heartbeat? __1__2__3__4__5__6__7

Never Always

20. I worry over money and studies __1__2__3__4__5__6__7

21. I blush more often than others __1__2__3__4__5__6__7

22. My hands and feet are not usually warm enough __1__2__3__4__5__6__7

23. I sweat very easily __1__2__3__4__5__6__7

24. I am easily embarrassed __1__2__3__4__5__6__7

25. I am more sensitive than most people __1__2__3__4__5__6__7

26. I frequently find myself worrying __1__2__3__4__5__6__7

27. I am unusually self-conscious __1__2__3__4__5__6__7

28. I am certainly lacking in self-confidence. __1__2__3__4__5__6__7

29. I am inclined to take things hard __1__2__3__4__5__6__7

30. I worry over possible misfortunes __1__2__3__4__5__6__7

31. I dream things best kept to myself __1__2__3__4__5__6__7

32. I am not usually calm and I am easily upset. __1__2__3__4__5__6__7

APPENDIX B

RAW DATA (Unscaled)
S.A.Q. Scores and GSR, EKG Scores

LOW ANXIOUS GROUP

			Mean G. S. R. in $\sqrt{c}$			
Subj. No.	Sex	SAQ Score	Anxiety	Threat	Neutral	Blank
1	M	81	.0101	.0121	.0089	.0063
2	M	84	.0598	.0632	.0648	.0191
3	M	95	.0483	.0532	.0490	.0433
4	M	102	.0708	.0955	.0609	.0381
5	M	104	.0435	.0439	.0396	.0346
6	F	105	.0457	.0476	.0458	.0317
7	M	108	.0520	.0434	.0489	.0000
8	F	108	.0799	.0685	.0830	.0305
9	F	109	.0373	.0391	.0381	.0299
10	M	109	.0829	.0888	.0706	.0733
11	M	109	.0487	.0603	.0600	.0301
12	M	110	.0722	.0999	.0764	.0436
13	M	110	.0535	.0570	.0590	.0385
14	M	111	.0435	.0580	.0281	.0181
15	M	111	.0252	.0389	.0100	.0168
16	M	112	.0787	.0858	.0800	.0617
17	M	114	.0767	.0842	.0569	.0438
18	M	114	.0619	.0700	.0550	.0457
19	M	116	.0330	.0353	.0264	.0281
20	F	118	.0705	.0678	.0548	.0358

				Mean E. K. G. in No. beats increase/minute			
	Subj. No.	Sex	SAQ Score	Anxiety	Threat	Neutral	Blank
	1	M	81	2.2	8.8	5.1	.6
	2	M	84	4.8	5.4	3.9	2.4
	3	M	95	4.2	6.6	7.2	2.1
	4	M	102	4.2	2.8	4.8	1.2
LOW ANXIOUS GROUP	5	M	104	6.6	5.8	2.7	1.2
	6	F	105	3.6	6.0	0.0	2.4
	7	M	108	11.6	11.2	10.6	5.0
	8	F	108	2.0	9.2	3.3	5.0
	9	F	109	1.2	5.4	0.0	0.6
	10	M	109	5.6	7.2	3.6	2.9
	11	M	109	3.4	8.4	6.6	3.0
	12	M	110	5.8	9.9	8.5	0.5
	13	M	110	7.4	8.4	9.6	7.8
	14	M	111	2.4	7.2	1.2	0.0
	15	M	111	3.6	7.6	4.8	3.6
	16	M	112	7.6	8.8	9.2	0.0
	17	M	114	3.2	3.6	2.55	2.4
	18	M	114	6.3	7.6	4.9	0.9
	19	M	116	9.9	5.4	1.8	5.4
	20	F	118	3.4	2.6	0.6	3.3

HIGH ANXIOUS GROUP

			Mean G. S. R. in $\sqrt{c}$			
Subj. No.	Sex	SAQ Score	Anxiety	Threat	Neutral	Blank
21	M	118	.0576	.0504	.0447	.0488
22	M	120	.0089	.0091	.0086	.0063
23	M	121	.0387	.0390	.0479	.0321
24	F	122	.0444	.0441	.0141	.0303
25	M	122	.0173	.0221	.0254	.0243
26	F	123	.0305	.0329	.0122	.0212
27	F	125	.0499	.0551	.0474	.0374
28	M	129	.0412	.0983	.0000	.0000
29	M	133	.0263	.0328	.0312	.0245
30	M	136	.0472	.0425	.0283	.0201
31	M	137	.0556	.0694	.0443	.0351
32	M	143	.0502	.0687	.0538	.0253
33	M	144	.0244	.0242	.0234	.0170
34	F	148	.0506	.0602	.0591	.0178
35	M	152	.0411	.0461	.0417	.0465
36	M	160	.0617	.0688	.0693	.0346
37	M	163	.0598	.0621	.0535	.0447
38	F	169	.0155	.0181	.0167	.0113
39	F	198	.0408	.0287	.0187	.0050

	S			Mean E. K. G. in No. beats increase/minute			
	Subj. No.	Sex	SAQ Score	Anxiety	Threat	Neutral	Blank
	21	M	118	1.3	0.2	0.3	5.1
	22	M	120	0.0	0.8	2.1	3.7
	23	M	121	5.9	7.2	7.5	1.2
	24	F	122	6.0	6.6	3.9	1.8
HIGH ANXIOUS GROUP	25	M	122	0.0	6.6	2.4	5.4
	26	F	123	2.9	5.1	0.0	0.3
	27	F	125	3.6	4.3	1.2	0.0
	28	M	129	2.1	5.1	2.1	0.0
	29	M	133	0.6	5.6	2.75	0.3
	30	M	136	2.2	5.2	3.8	0.6
	31	M	137	5.4	6.1	5.4	0.0
	32	M	143	2.0	3.0	0.0	0.0
	33	M	144	3.4	6.0	9.9	1.8
	34	F	148	8.8	10.8	10.2	2.4
	35	M	152	6.9	4.4	4.2	7.2
	36	M	160	5.4	3.0	2.4	2.7
	37	M	163	7.2	3.0	3.0	0.6
	38	F	169	6.5	8.4	4.2	7.8
	39	F	198	7.5	3.2	2.1	6.3

APPENDIX C

TEST-RETEST RELIABILITY OF S. A. Q.

A test-retest reliability of the S. A. Q. was calculated in the autumn of 1963 in order to ascertain whether or not the S. A. Q. is as reliable as the Taylor and Test Anxiety Questionnaire. The subjects for this little study were one hundred and fifty-five first year education students attending the University of Alberta and the questionnaire administrations were seven weeks apart.

A Pearson product-moment correlation coefficient expressing the relationship between scores on each testing was calculated. The value of this coefficient was found to be .70, which approximates other reliability coefficients for these questionnaires when they are used separately. The correlation, which is a reliability coefficient expressing relationship between scores obtained by the same measuring instrument, accounts for 70% of the variance common to both sets of scores and not 49% as would be the case if two different tests were used.

The raw scores are given below.

Subject	Score First Administration	Score Second Administration
1	102	140
2	142	128
3	104	122
4	132	156
5	88	119
6	106	107
7	95	139
8	153	165
9	114	105
10	95	113
11	109	122
12	85	92
13	122	115
14	149	135

Subject	Score First Administration	Score Second Administration
15	155	135
16	103	122
17	146	149
18	156	136
19	139	101
20	105	124
21	134	127
22	112	123
23	100	130
24	163	175
25	132	144
26	94	85
27	125	123
28	94	128
29	127	160
30	164	133
31	139	150
32	131	115
33	147	156
34	137	136
35	141	149
36	112	103
37	105	118
38	164	161
39	99	95
40	110	112
41	165	165
42	144	126
43	177	167
44	118	114
45	100	124
46	134	113
47	107	90
48	86	91
49	124	139
50	115	106
51	112	101
52	111	94
53	89	130
54	183	169
55	137	126
56	117	103
57	144	134
58	108	113
59	134	149
60	115	129

Subject	Score First Administration	Score Second Administration
61	149	138
62	83	75
63	131	134
64	153	163
65	148	163
66	161	126
67	122	136
68	126	156
69	116	123
70	123	139
71	109	123
72	122	100
73	155	163
74	122	137
75	110	106
76	148	143
77	114	112
78	118	127
79	114	113
80	134	143
81	143	153
82	131	150
83	148	140
84	138	113
85	130	127
86	138	103
87	117	81
88	128	104
89	114	115
90	146	188
91	108	89
92	106	100
93	146	139
94	102	95
95	124	137
96	145	152
97	121	109
98	107	106
99	133	141
100	103	98
101	171	175
102	126	106
103	120	126
104	147	142
105	118	123
106	119	135

Subject	Score First Administration	Score Second Administration
107	154	136
108	158	129
109	131	141
110	131	85
111	97	96
112	88	87
113	142	117
114	124	115
115	110	107
116	64	79
117	142	142
118	123	144
119	105	78
120	113	133
121	102	97
122	126	134
123	89	84
124	153	108
125	110	111
126	81	99
127	123	121
128	110	123
129	86	100
130	100	87
131	110	118
132	136	135
133	140	123
134	132	129
135	101	107
136	144	133
137	121	114
138	127	141
139	121	135
140	140	133
141	106	106
142	125	109
143	122	127
144	107	118
145	135	151
146	103	114
147	138	107
148	90	85
149	182	151
150	116	132
151	132	169
152	138	141

Subject	Score First Administration	Score Second Administration
153	156	145
154	111	125
155	126	123

N = 155

X_1X_2 = 2455124
X_1^2 = 2468000
X_2^2 = 2489161
X_1 = 19258
X_2 = 19323

Rx_1x_2 = .696 or .70

APPENDIX D

STIMULUS ITEMS

THREAT

1. He spit in his mother's face.
2. His brother kicked him in the stomach.
3. The prostitute slept with the student.
4. He enjoys sleeping with men.
5. After the operation he was impotent.

ANXIETY

1. Accelerated heartbeat before group IQ exam.
2. Perspire during course exam.
3. Accelerated heartbeat before a course exam.
4. Perspiring during individual IQ exam.
5. Worry over money and studies.
6. Blush more often than others.
7. Sweat very easily.
8. Easily embarrassed.
9. More sensitive than most.
10. Frequently worrying.
11. Unusually self-conscious.
12. Lack self-confidence.
13. Take things hard.
14. Worry about possible misfortunes.
15. Dreams best kept to self.

NEUTRAL

1. The horses worked well together.
2. The farmer dug a new well.
3. Tugs helped the ships reach port.
4. The dairy farm bought cows.
5. The steel company made new equipment.
6. Architects planned a home for the family.

APPENDIX E

PATTERN ON PRIMARY OBLIQUE AXES WHICH MEETS SIMPLE STRUCTURE CRITERION

$(F \Lambda D^{-1})$

PATTERN ON PRIMARY OBLIQUE AXES WHICH MEETS SIMPLE STRUCTURE CRITERION

$(F\Lambda D^{-1})$

		I	II	III
1.	Sometimes opens presents	154	182	-107
2.	Say sorry afterwards	119	488	071
3.	Start - not finished	-214	490	-021
4.	Am easily bored	043	391	-066
5.	Interested many things	113	305	-169
6.	Attention clothes	524	023	-175
7.	Keep things self	074	135	-201
8.	Lose temper easily	182	335	143
9.	Often excited	241	349	-028
10.	Pretty poised	-309	238	294
11.	School job marriage	-481	-183	088
12.	Stick job results	-060	181	177
13.	Likes change often	-059	525	108
14.	Group IQ perspire	145	004	877
15.	Ind. IQ perspire	099	000	876
16.	Bef. ind. IQ heart	426	016	638
17.	Course exam perspire	363	-024	763
18.	Group IQ heart	256	-146	752
19.	Bef. course heart	613	002	431
20.	Worry money studies	702	324	012
21.	Blush often others	000	731	048
22.	Hands feet not warm	000	233	152
23.	Sweat very easily	003	232	597
24.	Easily embarrassed	098	731	155
25.	More sensitive most	289	529	031
26.	Frequently worrying	671	385	204
27.	Unusually self-conscious	391	542	219
28.	Lack self-confidence	345	709	023
29.	Take things hard	770	484	048
30.	Worry misfortunes	627	471	020
31.	Dreams kept self	336	265	058
32.	Calm, not upset	446	599	221
33.	Sex	425	143	-206

APPENDIX F

ELEVEN UNROTATED FACTORS OBTAINED FROM PRINCIPAL AXIS FACTOR ANALYSIS S. A. Q.

ELEVEN UNROTATED FACTORS OBTAINED FROM PRINCIPAL AXIS
FACTOR ANALYSIS OF S. A. Q.

1.	Sometimes opens presents	126	186	069	373	-260	022	021	043	412	120	-369
2.	Say sorry afterwards	375	235	-201	-134	011	209	-163	-424	089	-425	097
3.	Start - not finished	154	317	-451	-011	-031	232	-177	193	321	259	346
4.	Am easily bored	208	284	-159	005	-009	226	-365	-087	037	132	-478
5.	Interested many things	141	308	-012	-605	116	441	-013	015	021	-105	104
6.	Attention clothes	191	132	499	-348	008	012	306	-153	060	-140	-136
7.	Keep things self	008	232	062	-472	-099	-353	007	258	-164	015	-199
8.	Lose temper easily	359	087	-088	016	-285	253	-420	-193	-209	-139	135
9.	Often excited	307	224	019	-269	-492	076	340	-155	118	301	315
10.	Pretty poised	130	-071	-508	369	199	-117	143	009	-334	001	052
11.	School job marriage	-305	-163	-339	223	-082	315	189	393	-002	-062	-003
12.	Stick job results	165	-024	-220	101	282	408	498	-021	-321	-072	-074
13.	Likes change often	323	235	-387	-102	-069	203	268	-207	033	434	-216
14.	Group IQ perspire	542	-667	-207	-043	-051	052	-034	-092	199	-071	-085
15.	Ind. IQ perspire	515	-668	-243	005	-023	-030	096	-137	209	-056	-133
16.	Bef. ind. IQ heart	567	-487	114	-059	-088	062	200	275	099	-018	144
17.	Course exam perspire	578	-604	037	-138	048	-011	-113	-066	-032	049	-106
18.	Group IQ heart	448	-666	019	009	-093	081	-089	195	038	-097	063
19.	Bef. course heart	546	-344	359	037	-049	187	-094	223	-130	150	178
20.	Worry money studies	552	164	410	093	194	081	-036	-097	-231	188	030
21.	Blush often others	438	402	-430	-050	-135	-162	-011	249	-122	-093	046
22.	Hands feet not warm	213	024	-188	231	-630	-149	002	-156	-303	-081	-101
23.	Sweat very easily	449	-314	-352	-275	088	-224	-004	-343	-214	210	031
24.	Easily embarrassed	546	318	-387	-107	089	-365	128	132	036	-092	049
25.	More sensitive most	465	285	-064	044	136	048	360	024	231	-411	-127
26.	Frequently worrying	672	056	277	256	219	-058	083	-106	-009	155	-034
27.	Unusually self-conscious	624	147	-055	-084	080	-475	009	014	205	-026	110
28.	Lack self-confidence	591	398	-115	342	219	-020	-132	065	037	-030	131
29.	Take things hard	696	231	364	112	-119	-065	-129	116	-036	-091	046
30.	Worry misfortunes	600	249	260	057	380	057	-052	053	-020	150	-073
31.	Dreams kept self	354	105	115	-260	-325	105	107	333	-236	-047	-228
32.	Calm, not upset	686	178	-041	046	-045	159	-190	221	-056	-009	-169
33.	Sex	191	230	359	474	-335	028	272	-221	-002	-077	147